

Surgical department profile focused on surgical oncology improves significantly the outcomes of major surgery for gastric cancer

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Introduction. Gastrectomy for cancer remains a challenge for both the patient and the surgical team. It is regarded as a high-risk surgery with extensive postoperative trauma and significant morbidity and mortality. The experience in the preparation and selection for operative treatment and surgery itself are important factors affecting the outcome. The aim of the study was to analyse, on the basis of the first 6 years of departmental functioning, whether the change in surgical department profile from general to oncological surgery affects the outcome of major surgery for gastric cancer.

Materials and methods. Data collected from 114 consecutive patients that underwent major surgery for gastric cancer in the first 6 years of activity of our department were retrospectively reviewed. The department was created on the basis of a previously existing general surgery unit. There were 87 radical and 27 palliative resections. Total gastrectomy was the most common procedure (84%). The material was divided into 2 groups: patients who underwent surgery during first 3 years of the department's existence (group I, n = 47) and patients who underwent surgery in the second 3-year period (group II, n = 67).

Results. In the second three-year period we found: a higher mean age of patients (67.7 vs 63.1 years), a higher rate of artificial feeding applied (94% vs 66%), a higher mean number of harvested lymph nodes (21.3 vs 15.9), a lower rate of oesophageal anastomosis leak (0 vs 8.5%) and an improved 2-year survival rate (62.7% vs 44.7%). All of the mentioned differences exceeded the level of statistical significance. Postoperative mortality was 1.5% in group II and 8.5% in group I ($p > 0.05$).

Conclusion. A surgical department profile focused on surgical oncology improves the outcome of major surgery for gastric cancer.

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Key words: gastric cancer, gastrectomy, treatment outcome, postoperative morbidity, perioperative mortality

Introduction

Gastric cancer ranks fourth on the list of causes of death in cases of oncological diseases in Europe and second on a global scale [1, 2]. For many years, total gastrectomy with an adequate lymphadenectomy has remained a standard procedure in the radical treatment of gastric cancer in spite of significant developments in combined treatments with the use of chemotherapy and radiotherapy [1–4]. Partial or subtotal resection is an admissible method of palliative treatment of gastric cancer, of radical treatment of some selected forms of this with peripheral location as well as —

apart from endoscopic methods — it is used for the treatment of early stages of gastric cancer [2]. At least 15 lymph nodes are required in the dissected specimen in order to apply the TNM system to determine the stage of disease progression [2].

The indicators of 5-year survival in European countries and the USA do not exceed 30% [3, 5, 6]. Therapeutic decisions concerning the treatment of a patient with a gastric cancer should be taken within a multidisciplinary team, thanks to which chemotherapy more and more frequently precedes gastric resection. The creation of a multidisci-

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plinary team is easier in an oncological centre. However, in the case of surgical patients, the course of treatment is determined by the team in the surgical department. Gastrectomy in cancer is connected with a significant perioperative trauma, perioperative mortality of a few per cent and poses a large challenge for the surgical and assistant team. Surgical skills, including the number of gastric resections performed within a year, also constitute significant prognostic factors in this disease [1].

These prognostic factors make up an image of the “surgical school” of the treatment of the gastric cancer. What matters in this school is also the patient care before the commencement of surgical treatment, in the process of the patient preparation and qualification for a surgery. Another element, apart from the actual procedure of gastric resection, is the perioperative and post-operative care, along with an adequate procedure for decreasing the risk of morbidity in these periods and the ability to diagnose complications in a due course and to react adequately to their occurrence. Within the process of creating a surgical school all team members taking care of the patient play a significant role, although the team leader always takes the key role. The oncological surgery department in this hospital was opened on 1 August 2006 and was created on the foundations of the previous general surgery department. The majority of the new team were general surgeons from the previous department. The new team was founded by a surgeon with 25-years of experience at the university clinic in oncological surgery with a specialisation in general surgery and oncological surgery. The clinic has always treated GI tract cancers and offered selective treatment for patients with cancer. When the department was created in 2006 only 2 surgeons (including the team’s founder) out of 8 people making up the team at that time had a specialisation in oncological surgery, apart from the specialisation in general surgery. Before 2006, in the general surgery department approximately 10 resection procedures were performed annually for gastric cancer. During the first years of the department’s existence, 8 surgeons received specialisation qualifications in oncological surgery and the department was completely profiled towards cancer treatment, with a majority of cases within the GI tract.

The objective of this paper is to analyse changes in the quality of immediate and long-term results in the treatment of gastric cancer by the newly created oncological surgery department set up in an oncology centre for the treatment of malignant cancers within the first 6 years of the unit’s existence.

Materials and methods

The analysis took into account 114 patients undergoing resection procedure for gastric cancer within the first 6 years of the existence of the Oncological Surgery Department of

the Oncology Centre in Gdynia. There were 87 radical and 27 palliative resections performed. A majority of procedures were gastrectomy surgeries ($n = 91$, 79.8%), including 5 multi-organ resections (4.4%). In 18 cases partial gastric resection was performed (15.8%), and in 5 cases (4.4%) — a resection of the gastric stump was performed for the cancer in the stump. After the gastrectomy, the continuity of the GI tract was restored with Roux en Y method. The study sample was divided into two groups: the patients operated on within the first 3 years of the department’s existence (group I, $n = 47$) and the patients operated on in the next 3 years (group II, $n = 67$). The analysis accounted for the age of the patients, the distribution of the pTNM stage (for statistical purposes stage 1 was grouped with stage 2, and stage 3 with 4), the total number of the resected lymph nodes, the percentage of splenectomies and the frequency of administration of artificial nutrition in the perioperative period, the amount of the transfused blood, the general number of complications and leaks of the oesophageal anastomosis, perioperative mortality and 2-year survival. The perioperative death was defined as the death during the hospitalisation period or the death after discharge within 30 days of the procedure. Table I contains a presentation of the factors concerning the characteristics of the patients and the applied type of treatment as compared in both groups.

Statistical analysis

The statistical analysis was performed with the STATISTICA data analysis software system, version 10, produced by StatSoft, Inc. (2011). The χ^2 Pearson and U Mann-Whitney tests and Pearson correlation analyses were used. For the survival analysis, the Kaplan-Meier method was applied and the difference between the groups was verified with the log-rank test. The results were regarded as significant with $p < 0.05$.

Results

The groups were compared in respect to the TNM stages according to the score and the type of the procedure performed. In group II, the median age was significantly higher and artificial nutrition was used much more frequently. The results of treatment in specific periods are presented in Table II.

In group II the average number of resected lymph nodes was higher and the rate of leaks of the oesophageal anastomosis was lower, and the 2-year survival rate was found to be higher. The 24-month survival curves within the two groups of the patients are presented in Figure 1.

No correlation between the use of the artificial nutrition and the frequency of the post-operative complications, including the leak of the oesophageal anastomosis was found. Also no correlation between the number of resected lymph nodes and the survival period was observed. However, a

Table I. Characteristics of the patients and the applied treatment of study groups

	Total	Group I (n = 47)	Group II (n = 67)	p value
Average age (median) (years)	65.8 (67.5)	63.1 (63)	67.7 (70)	p = 0.03
pTNM				
0+I	18	9 19	9	ns
II	29	10 (40.4%)	28 (41.8%)	19
III	49	16	33	
IV	18	12 28 (59.6%)	6 39 (58.2%)	
Early cancer	11 (9.6%)	4 (8.5%)	7 (10.4%)	ns
Artificial feeding	94 (82.5%)	31 (66%)	63 (94%)	p = 0.0001
Type of procedure				
Gastrectomy	91 (79.8%)	35 (74.5%)	56 (83.6%)	ns
Extended	5 (4.4%)	0	5 (7.5%)	
Total resections of the stomach stump	5 (4.4%)	3 (6.4%)	2 (3.0%)	
Resection				
Total/Subtotal	18 (16.8%)	9 (19.1%)	9 (13.4%)	
Radical	87	32 (68.1%)		55 (80.3%)
Palliative	27	15 (31.9%)	12 (19.7%)	ns

strong correlation ($p = 0.000001$) between the number of lymph nodes involved with the cancer metastases and the number of all resected metastases was calculated jointly for all the patients (Fig. 2). The patients with a 2-year survival had a similar number of the lymph nodes resected as those who died within the 2-year observation period (18.9 vs 19.3; ns). They also had a similar average nodal index (0.24 vs 0.31; ns).

Discussion

Invasive forms of gastric cancer continue to have a poor prognosis — this is why each potentially prognostic factor in this disease requires a thorough analysis. A potentially better prognosis is guaranteed by treatment in a highly specialised centre [7–10]. The annual number of gastrectomies, which would allow for a facility to be characterised as ‘highly specialised’ still remains disputable. Enzinger et al. evaluated the correlation between the annual number of total gastric resections in a specific department and the treatment outcomes. These authors regarded 14 gastrectomies per year as a high correlation co-efficient [7]. Large European academic treatment centres report 11.4–24.2 resection procedures annually [11–13]. In a study by American authors concerning gastrectomy in patients above 65 years of age with gastric cancer and treated in oncology centres and hospitals with a “large” number of surgeries, the median number for gastrectomies was 21 (scope 5–137) in oncology centres, and 30 (scope 25–69) in hospitals with a “large” number of surgeries [14]. In our sample the annual number of gastrectomies performed for adenocarcinoma grew from 15.6 in the first period to 22.3 in the 3 following years. In the

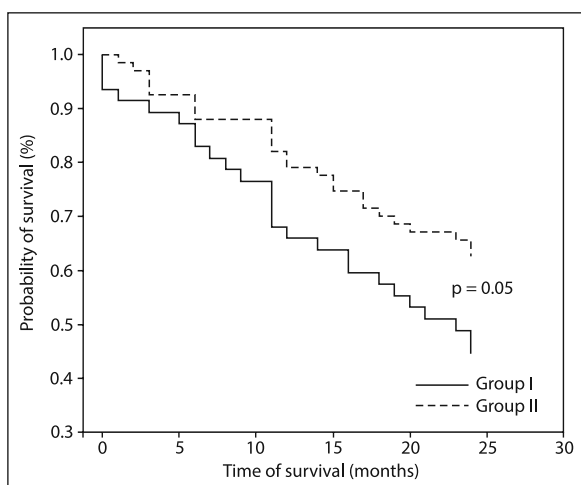
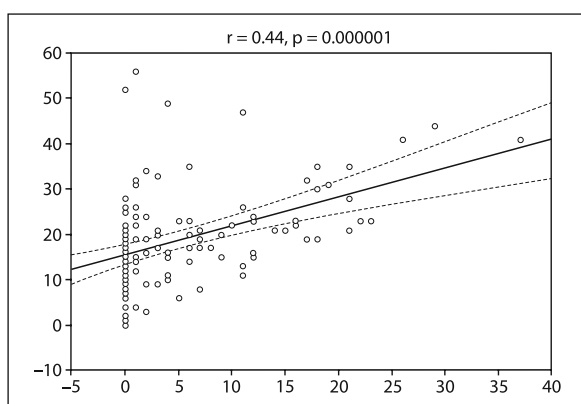
European context, these figures place our department (with the experience of the three last years) in the group of high specialisation centres.

Facilities performing a high number of extensive surgical operations are generally larger, better equipped and have a highly-trained multidisciplinary team. This facilitates more effective diagnostics and treatment of gastric cancer without any unnecessary delays at its various stages. Our department has the structure of an oncological centre, which makes it easier to take multidisciplinary decisions in our approach towards a patient with a gastric cancer. The multidisciplinary treatment process has taken hold in the second period of the activity in our department.

The better physical condition of a patient is another cause for better outcomes in treatment in large institutions with centralisation in diagnostics and multidisciplinary treatment. Usually, patients in a better physical condition are referred to larger, but still, very few centres far away from their places of residence, as such patients are able to sustain a longer journey to hospital [9, 14]. A comparison of various treatment centres for gastric cancer made by Smith et al. suggests that in the hospitals with the largest number of total gastric resections the rate of patients above 75 years of age was 15%, while in smaller, i.e. non-centralised centres — as much as 36%. The patients from smaller centres were more frequently burdened with comorbidities and they more often required the admission on an urgent basis, which generally fostered poorer outcomes of treatment [10]. In our case, from the moment of the creation of the department and for the entire 6-year period of observation, we have not found any significant differences in the selec-

Table II. Results of surgical treatment in both groups of patients

	Group I (n = 47)	Group II (n = 67)	Statistical analysis
Average number of resected lymph nodes (median)	15.9 (16)	21.3 (19)	p = 0.01
Average number of metastatic lymph nodes (median)	7.0 (4)	4.8 (2)	ns
Nodal index	0.35	0.21	ns
Splenectomies' rate	19.1%	11.9%	ns
Average number of PRBCs transfused (median)	1.8 (2)	2.3 (2)	ns
General rate of complications	27.7%	14.9%	ns
The rate of oesophageal anastomosis leak	8.5%	0%	p = 0.01
The rate of perioperative mortality	8.5%	1.5%	ns
2-year survival rate	44.7%	62.7%	p = 0.05

**Figure 1.** 24-month survival curves in both groups**Figure 2.** Correlation between the metastatic lymph nodes and the number of all resected lymph nodes

tion of the patients for surgical interventions. The quality of the equipment used for gastric resection procedures has also remained unchanged. The most significant changes leading to the improvement of treatment outcomes are, in our opinion: the specialisation of the department towards

oncological procedures and comprehensive training of the surgical and nursing teams towards the care of oncological patients (usually these are elderly patients). In our case, gaining experience together in the treatment of older patients with gastric cancer was translated to a higher median age of the patients treated within the last 3 years of the analysed period. The mean and median age in the patients in the second of the analysed periods was significantly higher. Surgeons and anaesthesiologists more frequently qualified for the surgical treatment of elderly patients, who were also often burdened with comorbidities.

An increase of the number of patients operated on for early gastric cancer is naturally conducive to the improvement of outcomes in the treatment of this disease [11, 12]. Among our patients, the distribution of the advancement stages of gastric cancer was similar in both study periods. It is worth observing that Poland still remains within a group of countries in Europe with lower survival rates for gastric cancer [15]. The aggregate rate of early gastric cancers in our sample was 9.6% for both groups and the difference between the two groups was insignificant. In Western Europe and in the USA this rate amounts to approximately 20% [13].

The general rate of complications reported by different centres varies significantly and in some instances was as much as 39% [3]. We have observed a significant heterogeneity in defining and reporting complications. In our study sample, this rate decreased by almost half within a short period, yet this difference has not reached the level of statistical significance. A universal exponent of the quality of a gastrectomy procedure is the rate of oesophageal anastomosis leak. It varies, depending on the source, from 1.6% to 8% [9, 11–13, 16]. In our department, we have managed to decrease the rate of anastomosis from a relatively high one (8.5%) to zero in group II (Tab. II).

A significant element which points to the quality of the treatment of GI tract cancers in a given centre, is the rate of perioperative mortality. It is especially significant in the case of surgical treatment of oesophageal and pancreatic cancer [7, 8, 17–19]. Perioperative mortality following gastrectomy

procedure in some European countries and in the USA frequently exceeds 5%. Only some centres report the number of perioperative deaths on the level of 2% [4, 8, 11, 12, 16, 18]. The values obtained in our study (Tab. II) prove the improvement of the entire patient care, however the difference between the studied groups, although clearly observable, has not reached the level of statistical significance.

An increase in the number of resected lymph nodes is another factor in the improvement of the quality of stomach cancer surgery [1]. Although the therapeutic value of extensive lymphadenectomy still remains a controversial issue, it definitely affects a more precise evaluation of the cancer advancement stage [1, 16, 18, 20]. The authors of the study, which is based on the results of 1853 radical gastrectomies from 6 Italian centres, proved almost an identical rate of 5-year survival in the groups above and below 15 resected lymph nodes [21]. Some authors propose the nodal index as a prognostic factor, i.e. the rate of the lymph nodes involved with cancer metastases to the overall number of resected lymph nodes [20, 21]. Our sample did not show any prognostic value of the rate calculated in this way in relationship to a two-year survival. The intention of the majority of lymphadenectomies performed in our centre, as declared by the surgeons, was the scope of the nodes: D2. We have shown a strong positive correlation between the overall number of resected lymph nodes and the number of lymph nodes involved with metastases (Fig. 2). Some similar results were obtained by other authors [6, 10, 20–22]. Although, in our study sample, the number of lymph nodes with metastases was lower on group II, the difference between the groups did not reach the level of statistical significance ($p = 0,3$). The presence of lymph nodes affected with metastases macroscopically fosters a larger number of nodes resected by the surgeon as well as a larger number of nodes found by the pathologist in the specimen. In our sample, however, in the second observation period the number of lymph nodes evaluated by the pathologist was significantly higher in the initial period of the department's existence and the mean and median number of the metastatic lymph nodes was lower. This is indirectly conducive to a better technique of gastric resection procedure.

We regard the core achievement of the team to be the increase of the 2-year survival rate in group II to 62.7%, with a zero rate of clinically overt oesophageal anastomosis leak in the second of the two 3-year evaluation periods. It is worthwhile to stress that the majority of patients in both groups had 3rd and 4th stage cancer. A comparison of treatment outcomes for gastric cancer in the Netherlands, Denmark, Sweden and England shows that 2-year survival rate after a gastrectomy for cancer falls between 51.7%–56.3% [5].

Undeniably, a significant prognostic role is still played by the operating surgeon [1]. An increase in the number of surgeons in the departments specialising in general surgery

and oncological surgery and the many years of experience in the care of only cancer patients seems to be the likely cause of the significant decrease of the risk of oesophageal anastomosis leak after stomach resection in the ward. The increase in nutritional treatment in the periods preceding and following surgery is also a probable cause of decreased morbidity and better treatment outcomes in the second period analysed in the study.

Conclusions

The model of a surgical department focused solely on the treatment of cancers and functioning within the structure of an oncological centre fosters improvement in the treatment of patients with resectable gastric cancer.

Conflict of interest: All authors declare no conflict of interest

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